Occasional Paper 162 1958

CATTLE GRAZING IN LONGLEAF PINE FORESTS OF SOUTH MISSISSIPPI

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CATTLE GRAZING IN LONGLEAF PINE FORESTS OF SOUTH MISSISSIPPI

By

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The forest range has long been an important source of inexpensive forage for livestock on the Gulf Coastal Plain of south Mississippi and adjacent States. Mild winters and ample rainfall have made possible yearlong grazing by cattle with little supplemental feed or herd management. Open-range grazing, however, is accompanied by low animal productivity, inefficient utilization of the forage, and frequent damage to timber. This type of cattle grazing no doubt reached its greatest development on cutover, poorly stocked longleaf-slash pinelands.

During the past 40 years, there has been a gradual improvement in cattle breeding and management on many farms located on the better soils of the area. These farms have cultivated fields suitable for limited production of hay, and pasture for winter feeding and grazing. But some 70 percent of the area is still timberland, and forest range thus remains an important source of forage.

Increased worth of both range cattle and young timber has in recent years stimulated interest in improved practices for grazing cattle and growing timber on the same land. The problems of such integrated land-use include 1.--improvement in yearlong herd management, 2.--supplemental pastures or feeding, 3.--efficient utilization of the native forage, 4.--protection and management of timber stands, 5.--economic use of the reduced amount of forage under moderate to well-stocked pine stands of merchantable age.

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The authors are deeply indebted to the agencies and coworkers who helped make the study possible. The South Mississippi Branch of the Mississippi Agricultural Experiment Station supplied the cattle, and John B. Gill and other members of the Branch staff provided weight records on the stock, Marvin Gieger, of the Chemistry Department, Mississippi Agricultural Experiment Station, supervised the chemical analyses of the forage samples. Horace D. Smith, of the Southern Forest Experiment Station, assisted in managing the herds while they grazed on the McNeill Experimental Forest, and took many of the forage measurements.

Several of these problems were studied from 1947 to 1953 on the McNeill Experimental Forest, a 1,210-acre tract of second-growth longleaf pineland in Pearl River County, Mississippi. The results here reported deal with the amount and nutrient value of forage under various pine stands and densities, and with cattle gains during two grazing seasons: spring and spring-summer. Such information is basic to improved management and effective use of native forage on second-growth longleaf pinelands. The findings are mainly applicable to the upland longleaf pine type in south Mississippi and southeast Louisiana, but also are pertinent to south Alabama and southwest Louisiana.

STUDY AREA AND PROCEDURE

About 80 percent of the McNeill Experimental Forest is gently rolling upland, and 20 percent is in stream bottoms or moist sites. Average elevation is about 230 feet. The longtime average annual rainfall is approximately 60 inches, but during 1947-1953 the annual average was 66 inches.

A previous experiment, from 1923 to 1933, measured the effects of grazing and annual burning on young longleaf pine stands and on native forage in two areas of approximately 160 acres each (9)[2].

In 1947, two additional 160-acre areas were fenced, making a total of 4 pastures available for grazing studies (fig. 1). Pasture E, which was burned annually in the 1923-33 study, and Pasture F, which remained unburned during 1923-33, were rather well stocked with longleaf pine. On the two new pastures, A and C, the timber stand was more open than on E and F. Two ungrazed areas of 160 acres each (B and D) were reserved for observations of timber and forage development.

The second-growth pine stands are managed primarily for high-quality sawlogs under an even-aged silvicultural system. The first thinnings were started in 1947, when the average age was about 35 years. Periodic thinnings are scheduled at 3, 5, and 8 years in the different 40-acre compartments. These thinnings gradually open up the stands by removing the smaller and poorer trees for logs, poles, and pulpwood.

To increase the natural longleaf reproduction in the larger openings, prescribed burns were made to improve the seedbed and to control the brown-spot disease. Other silvicultural measures included deadening of unmerchantable upland hardwoods and cutting merchantable dogwood to release young pines. In general, these treatments temporarily

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[2] Underscored numbers in parentheses refer to Literature Cited, page 25.

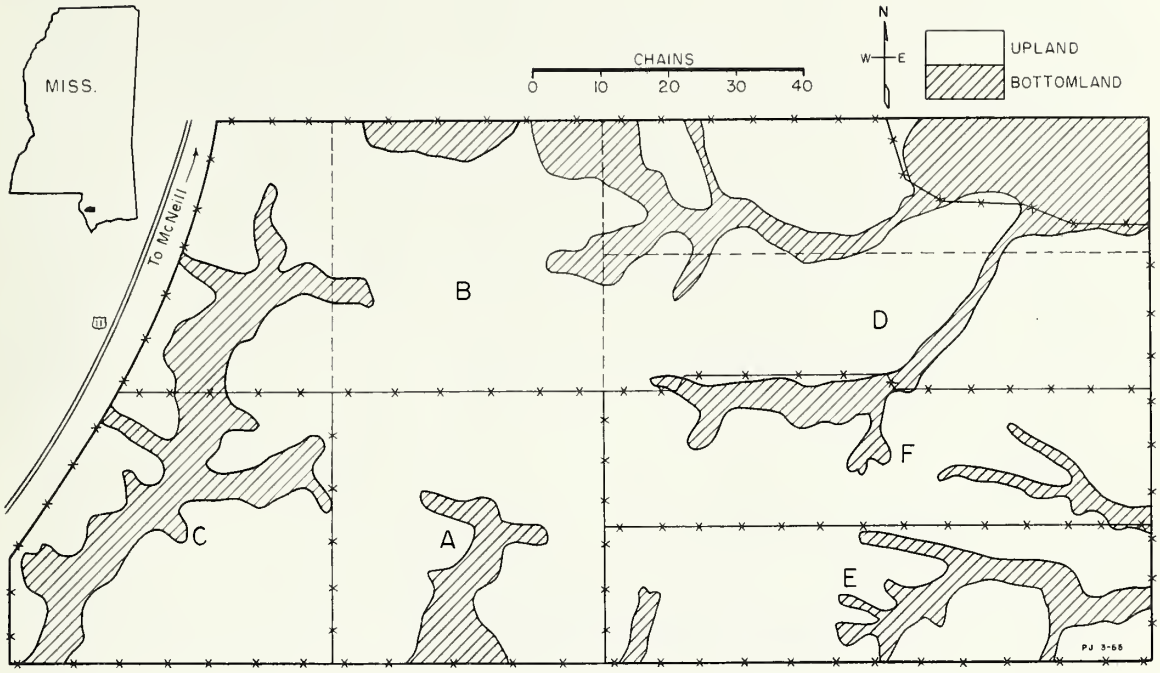

Figure 1. --The experimental area.

provided more growing space for forage, but were soon offset by the expanding crowns of the remaining pines.

Each winter, a firebreak about one chain wide was burned inside the boundaries of the experimental forest. These protection fires provided a small acreage of fresh burns for cattle grazing.

In 1950, 1951, and 1952, small thin yearling steers were purchased locally each spring for the study pastures and sold in the fall. They were of mixed breeds, with native stock predominating (fig. 2). Before being placed in the pastures, all animals were vaccinated and treated for internal parasites. The steers were grouped to provide approximately the same average weight per animal in each pasture. During the study, each animal was weighed at 28-day intervals. Cattle numbers were adjusted to allow for variations in the grazing capacity of the different pastures.

The study compared a grazing season of 4 months with one of 7 months. The short season, extending from about April 1 to July 31, was intended to coincide with the main period of rapid grass growth through the early leaf and full leaf stages. The long season, from about April 1 to October 31, included the total growing period of the principal forage plants through the mature green leaf stage. The purpose of the short season was to test the feasibility of utilizing the forage while it is

Figure 2.--A group of steers in a moderately stocked longleaf stand in pasture A.

most palatable and nutritious, then moving the animals to improved pastures for the remainder of the summer to maintain a high level of gains.

In 1953 and 1954, two small herds of breeding cows were furnished by a local farmer for supplemental tests with this class of stock.

In 1947, 1948, and 1949, the amount and quality of forage was measured on ungrazed sample plots 3.1 feet square (2). Burned and unburned range was sampled under pine stands of three densities: fully stocked, moderately stocked, and open. The object was to test the effects of burning and tree density on forage growth and nutrient content.

From 1949 to 1952, inventories of the forage were made in selected pastures in July and September, near the end of each of the two grazing seasons.

Samples of the plants preferred by cattle were obtained by observing the animals periodically in two pastures during the 3 years and collecting samples of the plants they ate. The Mississippi Agricultural Experiment Station made chemical analyses of the samples.

THE FORAGE

The forage plants on the experimental pastures are fairly typical of those on longleaf lands in south Mississippi. Although more than 50 species of grass are present, a few provide most of the forage.

Little bluestem[3] and slender bluestem are the most important. Other common species are Elliott, paintbrush, and yellowsedge bluestems, several panicums, pineywoods dropseed, threeawn, Florida paspalum, bearded skeletongrass, and carpetgrass. In the lowland types, panicums, sedges, rushes, and switch cane provide considerable forage.

Several native legumes and other weeds, including tick clover, common lespedeza, swamp sunflower, and goldaster, were grazed in the spring. Browse plants such as southern waxmyrtle, sweetleaf, and blueberry furnished some forage in the early leaf stages in spring.

Under the close grazing during the early experiment, grass density decreased in the burned pasture from 62 percent in 1923 to 21 percent in 1933, and dropped from 79 to 22 percent in the unburned (9). Little bluestem and slender bluestem decreased in both pastures, while carpetgrass and other grasses increased.

Between 1933 and 1949, the experimental forest was grazed lightly. Only parts of the area were burned, and at irregular intervals. As a consequence, when the forage inventory was taken in 1949 grass density had increased to 28 percent. The little bluestem had increased from about one-fourth of the grass stand to more than half (table 1).

Table 1.--Proportions of the principal grasses in Pastures E and F, in 1924, 1933, and 1949 1/

Species	E--burned annually 1924-33			F--unburned 1924-33		
	1924	1933	1949	1924	1933	1949
	- - - - - - Percent - - - - - -					
Little bluestem	41	23	58	38	26	55
Slender bluestem	25	21	11	35	17	16
Carpetgrass	4	10	5	1	10	2
Other grasses	30	46	25	26	47	27

1/ Pasture E was called Pasture B in the 1923-33 experiment, while Pasture F was named Pasture A in the earlier study (9).

[3] See page 24 for common and botanical names of range plants mentioned in this publication.

Slender bluestem had decreased somewhat, carpetgrass was greatly reduced, and other grasses had declined from barely half to about one-fourth of the stand. Thus, under light grazing from 1933 to 1949, little bluestem again became the dominant grass in the pastures.

Effects of Timber Density and Stand on Grass Production

In the three-year period 1947 to 1949, grass yields were measured on 10 plots each in open, moderate, and dense pine stands to determine the effect of timber density on the amount and quality of forage (figures 3 and 4). In open stands having about 30 pines per acre four inches d. b. h. or larger, the average annual yield of green grass (air-dry weight) was 850 pounds per acre. In moderate stands with about 225 trees per acre, grass production was 450 pounds per acre. In dense stands having about 300 trees per acre, the yield was 400 pounds per acre annually.

Much of the forage that did grow in the dense stands was so mixed with pine needles that the cattle would not use it. In 1947, the dense pine stands averaged 6, 850 pounds of needle litter per acre on unburned areas,

Figure 3. --Timber density largely determined the quantity of forage produced. The cattle found little grass under this dense unthinned pole stand in pasture E.

Figure 4. --In this open stand in pasture C, heavy growth of bluestem grasses provided ample forage.

the moderate stands had 3,755 pounds of litter, and the open stands had very little. These results show that as the pines grow and occupy more space, grass yields are greatly reduced by severe competition from trees and by smothering from litter.

The effect of timber density on grass growth is corroborated by data from pasture forage inventories between 1949 and 1952 (table 2). In longleaf pine pole stands, well-stocked areas produced the least grass,

Table 2. --Green grass (air-dry) per acre in July on unburned plots, 1949-1952

Year	Longleaf pine				Slash pine	Slash pine-bottomland hardwoods
	Pole stocking			Reproduction		
	Good	Medium	Poor			
	- - - - - - - - - - Pounds - - - - - - - - - -					
1949	494	821	1,136	1,033	1,328	500
1950	355	735	1,190	995	1,320	500
1951	169	387	619	615	690	609
1952	112	262	480	442	376	139
Average	282	551	856	771	929	414

medium stands had somewhat more, and poorly stocked stands had the most grass. Open longleaf stands with reproduction had somewhat less grass than those without reproduction. Slash pine stands usually had more grass than open longleaf areas, chiefly because they had a higher proportion of slender bluestem. The most stable production was in longleaf pine stands that were poorly stocked or in the seedling stage. Variation from year to year was greatest in well-stocked pine stands. Grass production in the bottomland held up well from 1949 to 1951, but dropped to a low during the dry year 1952. These annual fluctuations in grass production have an important bearing on grazing capacity.

Effects of Rainfall on Grass Production

Rainfall has a major influence on grass growth, both during the individual season and from year to year. Figure 5 shows grass production in open unburned McNeill stands in relation to seasonal rainfall.

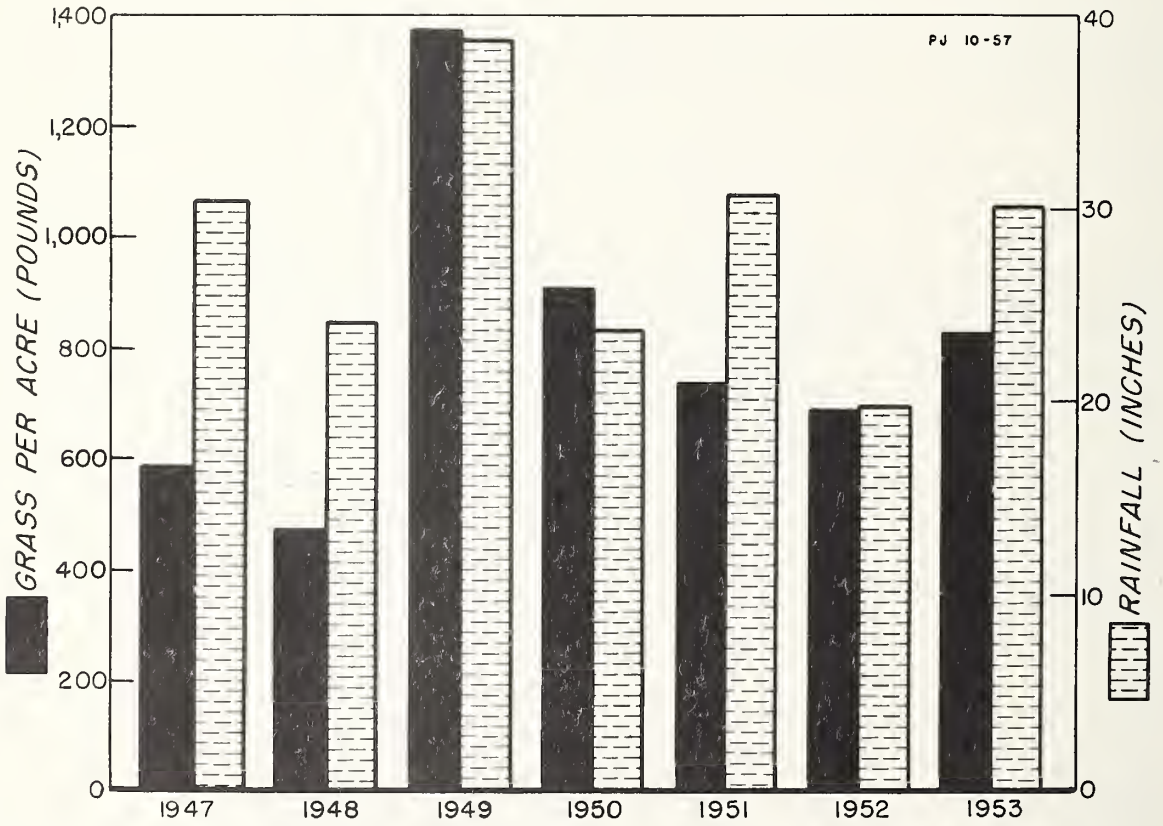

Figure 5. --Relation between seasonal rainfall, April through August, and maximum annual grass production in open, unburned pine stands. McNeill Experimental Forest, 1947 to 1953.

Average maximum grass growth for the seven years was 799 pounds per acre. The lowest production was 474 pounds per acre in 1948, about 40 percent below average. The highest was 1,375 pounds per acre in 1949, some 72 percent above average, and almost three times that of the poorest year.

These differences in forage production between years are largely caused by variations from normal rainfall during the spring and summer months. For the 7 years of the study, monthly average rainfall in inches during the growing season was:

March	9.15	July	6.79
April	6.29	August	5.35
May	4.08	September	6.45
June	5.75	October	1.39

In most years, there is enough rain in March and April to give the grass a good start. In May, however, rainfall was less than 4 inches in five of the seven years, so that the rate of grass growth slowed down perceptibly. For example, in 1950 the grass yield in April was 688 pounds per acre, partly because the panicums made good early growth. But in May, when only 2.03 inches of rain fell, the panicums largely dried up and only 438 pounds of green herbage per acre was measured.

When rainfall was well distributed, bluestems usually made good growth through June, July, and August, with slender bluestem putting up flowerstalks in late July, and the coarse-leaved bluestems following in August and September. In October, a month of low rainfall, green grass production decreased. In brief, April through August appears to be the critical period for rainfall. Rainfall for these months is compared with maximum annual grass production in figure 5.

The cumulative seasonal curve of grass production in open unburned pine stands is shown by the heavily inked curve in figure 6. About 70 percent of the year's production was reached by June, and 85 percent by July. This corresponds with Cassady's findings in central Louisiana that about 70 percent of the grass, and by far the most nutritious part, is produced during the first half of the growing season (4).

Figure 6 also compares the average grass-production curve with that of 1949, the highest year, and that for 1948, the year with lowest production. In every year except 1949, short droughts reduced or halted grass growth. Growth losses early in the season were not fully recovered even when rainfall in later months was adequate. For example, in the poorest year, 1948, below-average rainfall held down grass growth so greatly in April, May, and June that ample rain during the hot months of

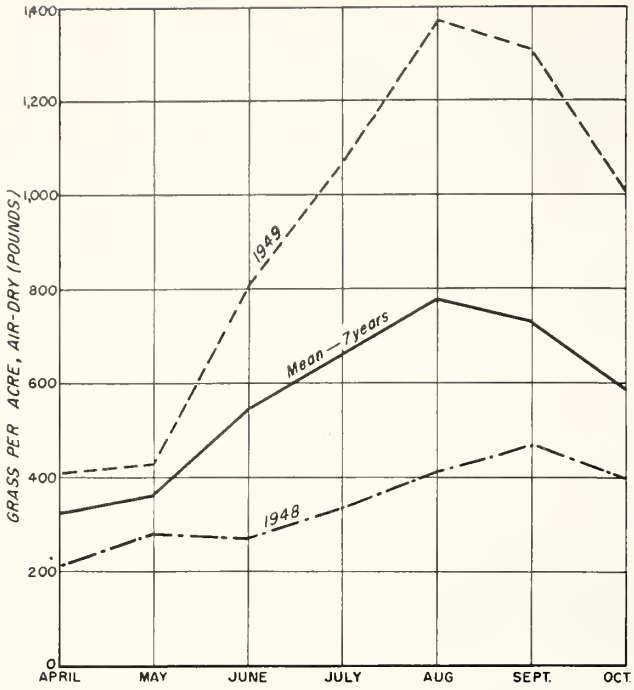

Figure 6.--Cumulative grass production in open, unburned pine stands, 1947-53.

July, August, and September could not overcome the deficit. Maximum production for the year was not reached until September, and was only 474 pounds per acre.

The net effect of good seasonal rainfall is reflected not only in high grass production, but also in a succession of green grasses that provides a longer season of good grazing than would a single species. Any temporary drought, particularly from April through July, reduces total production and disrupts the succession of species.

Forage inventories were made in the grazed pastures and in ungrazed pasture B in September 1949, before grazing began, and in July 1950, 1951, and 1952. Additional inventories were made in the long-season pastures C and E during October of 1951 and 1952. Green grass production (air-dry) in pounds per acre by pastures and years is shown in table 3.

Table 3.--Grass production (air-dry) per acre, 1949-1952

Month and year	Short-season pastures		Long-season pastures		Ungrazed pasture B	All pastures
	A	F	C	E		
	- - - - - - - - - - Pounds - - - - - - - - - -					
September 1949	1,119	794	704	729	948	865
July 1950	902	591	531	528	673	649
July 1951	538	360	363	340	445	412
October 1951	...	...	382	352	...	...
July 1952	378	210	182	182	236	239
October 1952	...	...	371	264	...	...
Average (July-September)	734	489	445	445	576	541

The variation from year to year in the pastures was very similar to that already reported for the special seasonal forage-production plots. Production was highest in 1949 in all pastures, and lowest in 1952. The average total for all five pastures in 1952 was only 28 percent of that in 1949. The average in all pastures for the four years was 541 pounds per acre, or only 63 percent of that in 1949.

GRAZING IN THE PASTURES

Cattle Diet and Forage Utilization

Grasses, which are by far the most abundant kind of range plants in south Mississippi, made up about 93 percent of the season-long steer diet on the experimental ranges from 1950 through 1952 (table 4). Grasslike plants constituted barely one percent, weeds (broad-leaved herbs or forbs) 3 percent, and browse 3 percent. The bluestem grasses alone contributed four-fifths of the average diet. The larger, coarse-leaved bluestems were the mainstays of the steer diet, averaging 66 percent for the season, with a low of 31 percent in March and a high of 89 percent in July. The smaller, fine-leaved bluestems (mainly slender bluestem) averaged 15 percent of the diet for the season, but made up 34 percent when fresh and lush in May, and 30 percent in September.

Table 4.--Average cattle diet, 1950-1952

Species	March	April	May	June	July	August	September	October	Average
					-Percent-				
Coarse-leaved bluestems	31	78	45	61	89	80	65	80	66
Fine-leaved bluestems	8	2	34	27	4	10	30	3	15
Other grasses	36	10	15	10	6	8	3	14	12
All grasses	75	90	94	98	99	98	98	97	93
Grasslike plants	3	1	0	0	0	0	0	0	1
Weeds	5	6	4	2	1	2	1	2	3
Browse	17	3	2	(1/)	0	0	1	1	3
Total	100	100	100	100	100	100	100	100	100

1/ Trace.

Other grasses contributed at particular seasons of the year. The panicums were grazed eagerly in March, when the bluestems were just starting growth. Carpetgrass, dropseed, and paspalums were a small but continuing source of green forage.

Grasslike plants, mainly sedges, were grazed in March and April but dried up thereafter.

Several succulent weeds supplemented the grasses, especially in spring and early summer.

When the steers were placed on the range in March, they immediately ate considerable browse, such as sweetleaf, blackberry, sumac, and blueberry. Browse made up 17 percent of the diet in March, but rapidly dropped off to a negligible amount by June.

Knowledge of the kinds and amounts of the various plants grazed by cattle is essential in planning good range management. Equally important is an understanding of the factors influencing the utilization of a pasture as a whole, and the distribution of utilization within a pasture. Overall pasture utilization is largely the result of the amount of forage produced for the season or year and the kind and number of animals grazed.

The four grazed pastures were only lightly to moderately utilized during the three years they were stocked with steers. With high forage production and low animal numbers (36 steers) in 1950, average utilization for the four pastures in July was estimated at 11 percent. In the two succeeding years, when forage growth was less and animal numbers had been increased (48 steers), estimated utilization in July averaged 17 percent in 1951 and 16 percent in 1952. Among the individual pastures, the lowest utilization was 10 percent in A and E in 1950, and the highest was 26 percent in E in October 1951 (table 5). Proper use was considered to be about 40 to 50 percent.

Within the individual pastures, distribution of animals, and therefore utilization, was influenced by location of water supplies, roads, fence lines, and salt; and by reseeding, fertilization, and burning.

Table 5.--Utilization of grass herbage by steers, 1950-1952

Year and month	Short-season pastures				Long-season pastures				Average for all pastures
	A		F		C		E		
	Average	Burned 1/	Average	Burned 1/	Average	Burned 1/	Average	Burned 1/	
	Percent								
1950									
July	10	...	12	...	12	92	10	66	11
November	...	...	...	...	13	83	10	23	12
1951									
July	14	...	19	...	19	54	15	37	17
October	...	...	...	...	23	48	26	43	24
1952									
July	17	84	17	88	15	81	13	...	16
October	...	...	...	...	24	64	25	...	25

1/ Utilization in "burned" column represents cattle grazing on firebreaks and other small areas prescribe-burned the year before grazing started.

In 1950, pasture A was unburned. Estimated utilization in July averaged 10 percent, but varied from 0 to 27 percent in the uplands and ranged up to 35 percent on limited spots near water holes in the bottomland. Utilization was recorded for the 15 to 20 feet adjacent to each of several objects as follows:

Object	Utilization (percent)
Logging roads	15 to 25
Fence lines	15 to 20
Salt box	20
Pine stumps	20 to 25
Deadened hardwoods	20 to 25

A fertilized and seeded area was closely grazed, but adjacent native forage was utilized only about 20 percent.

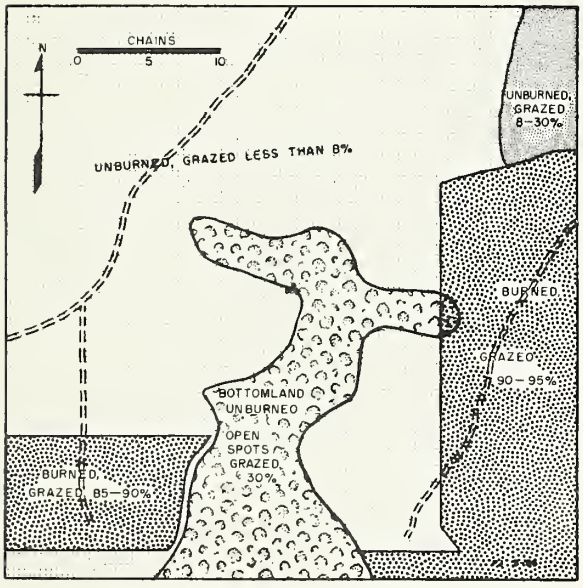

Figure 7.--Utilization map of Pasture A, July 1952, showing estimated utilization zones after 4 months of grazing by 16 steers.

The tremendous effect of burning on utilization is shown in table 5. Most areas of fresh burn were utilized 50 to 90 percent. Figure 7 shows the utilization, in July 1952, of Pasture A, parts of which were prescribe-burned in February 1952. The grasses on the burned areas were utilized 85 to 95 percent. Unburned uplands were generally grazed less than 10 percent; many areas were ungrazed. Spots in the bottomland were grazed up to 30 percent. Roads, salt boxes, and nearness to the swamp had comparatively little effect on utilization and then no more than a few yards away.

Nutrient Value of Forage

Analyses of ungrazed native grasses showed that nutrient values were highest in the early leaf stages--that is, during the period of most rapid growth. In the spring, crude protein ranged from 8 to 13 percent in grasses growing under the different kinds of pine stands. In early

summer, when grasses reached the full leaf stage, protein content in these ungrazed grasses dropped to about 6 percent and remained at low levels for the rest of the season. Except in spring, protein values were below the minimum 8 to 9 percent required by beef breeding animals (7).

Chemical analyses of cattle diet samples for 1951 and 1952 (table 6) showed a high of 9.02 percent crude protein in March. After the grasses reached full leaf, they were less palatable and cattle preferred the regrowth on areas previously grazed closely in the spring. Cattle diet samples of new growth on areas previously grazed showed 8.42 percent protein in May to 6.58 percent in September. The higher nutrient content of new growth on previously grazed areas probably explains the patchy utilization characteristic of forest ranges.

Table 6.--Analyses of cattle-diet samples for 1950 and 1951 (moisture-free basis, average for two years)

Month	Crude protein	Phosphorus	Calcium	Total ash
	- - - - - Percent - - - - - -			
March	9.02	(1/)	0.42	9.94
April	7.96	0.11	.37	6.92
May	8.42	.12	.40	7.70
June	6.85	.10	.34	6.09
July	7.28	.10	.33	6.99
August	(1/)	(1/)	(1/)	(1/)
September	6.58	.10	.42	7.03
October	(1/)	(1/)	(1/)	(1/)
November	4.88	.06	.38	7.11

1/ No samples taken.

Several native weeds and legumes had a higher protein value, but were less abundant than grasses and were grazed mainly in their immature stages.

In early leaf stages, phosphorus values in ungrazed native grasses ranged from 0.15 to 0.20 percent. However, the cattle diet samples showed only 0.10 to 0.12 percent phosphorus from April to September. To compensate in part for the low phosphorus content of the forage, mineral supplements of salt and bone meal were provided in all pastures during the study.

Calcium content of ungrazed grasses ranged from 0.22 to 0.40 percent, moisture-free. In the cattle diet samples, calcium varied from 0.33 to 0.42 percent. It apparently was adequate for cattle throughout both the short and long grazing seasons.

Protein and phosphorus values were higher on burned than on unburned range, but the differences were too small to affect grazing values. Neither did differences in forage nutrients under the different rates of timber stocking appear significant in cattle nutrition.

Analyses of similar forest range forage in central Louisiana indicated that energy values are deficient during much of the year (3). It appears that the range forage provides adequate total energy for cattle breeding herds only when animals can secure a fill of grass in the young-leaf and early full-leaf stages. Protein and mineral deficiencies in Louisiana were very similar to those at McNeill.

Grazing Capacity

Grazing capacity is the number of grown cattle that can safely graze a range unit for the proper season each year over a period of years. It is based on utilization of the better forage plants at a degree that will assure their continued productivity (about 40 to 50 percent utilization of the current year's growth of little bluestem). To allow for year-to-year variations in forage production, a practical rate of stocking must be considerably under the maximum year and somewhat over the poorest year.

At McNeill, the 4 grazed pastures showed a maximum grass production (air-dry) of 865 pounds per acre in 1949, and a minimum of 240 pounds per acre in the very dry summer of 1952. Average production for the 4 years was 541 pounds per acre, of which not more than half, or about 270 pounds, could be removed without injury to the plants. As insurance against running short of forage in a dry year, many stockmen also allow a safety margin of about 25 percent of the average usable forage. With such an allowance, about 200 pounds of forage per acre annually were available for grazing at McNeill.

The small 350-400 pound steers used in the study consumed 8 to 10 pounds of grass (air-dry basis) apiece each day. This is about half the estimated requirement of 18 pounds for grown cattle averaging 700 pounds on range in central Louisiana (3). It is calculated that the McNeill pastures, averaging 200 pounds of usable forage per acre, would have a grazing capacity for mature range cattle of about 11 cow-days per acre (200 ÷ 18). This would amount to 11 acres per cow for a 4-month season (120 days ÷ 11), or 19 acres per cow for a 7-month season (210 days ÷ 11).

The capacity of the entire 646 acres of grazed pastures at McNeill would be about 60 grown cattle for 4 months, or about 32 head for 7 months. Small steers, similar to those used in the experiment, would require only about half the acreage needed for grown stock.

Based on the forage production shown in table 2, the estimated grazing capacity for each timber stand classification would be as follows:

	Per cow	
	One month (acres)	7 months (acres)
Longleaf pine		
Poles, good stocking	4.7	33
Poles, moderate stocking	2.4	17
Poles, poor stocking	1.6	11
Reproduction	1.7	12
Slash pine	1.4	10
Slash pine-bottomland hardwoods	3.3	23

These estimated capacities should be helpful to the forest owner or farmer interested in determining the approximate grazing of his forest range. For the 7-month season on the grazed McNeill pastures, this works out as follows:

	Total (acres)	Per cow (acres)	Cows (number)
Longleaf pine			
Poles, good stocking	270	33	8
Poles, moderate stocking	76	17	4
Poles, poor stocking	94	11	9
Reproduction	75	12	6
Slash pine	14	10	1
Slash pine-bottomland hardwoods	117	23	5
Total	646	106	33

The above tabulation, calculated by types, shows a grazing capacity of 33 head for 7 months on the 646 acres.

Where a part of the range is burned, of course, the cattle concentrate on the burned area and grazing capacity must be calculated mainly on the burned portion, at least for the spring after burning. There is some grazing on unburned range in summer and fall.

It is of interest to compare the grazing capacity of the McNeill pastures for 1949-53 with that during the earlier experiment.

For the 1949-53 experiment in mainly second-growth pole stands of longleaf pine, the estimated capacity was 19 acres per cow for a 7-month season. The average stocking during the 1923-33 experiment in open and young longleaf stands was about 9 acres per cow for a 7.5-month season, varying from 5 to 10 acres in different years. Undoubtedly, there was overgrazing in some years.

Effect of Cattle Grazing on Timber

Since the McNeill tract is now being managed primarily for timber, the influence of cattle grazing on tree reproduction and growth is of major importance.

From 1923 to 1933, the survival of longleaf pine seedlings that came in during the course of the experiment ranked from highest to lowest, as follows, under the various land treatments: 1.--unburned and ungrazed, 2.--unburned and grazed, 3.--burned annually and ungrazed, and 4.--burned annually and grazed. By 1933, survival of seedlings from the heavy 1924 seed crop was 43 percent on unburned and ungrazed areas, as against 5 percent or less on the other three land treatments. It was concluded that browsing by cattle probably injured a few of the smaller seedlings, but that on the whole the injury was negligible except under heavy grazing or on carpetgrass areas (all carpetgrass areas were closely grazed regardless of stocking).

Under the light grazing from 1950 to 1954, there was no appreciable damage to pine reproduction. The youngest longleaf seedlings were two years old when grazing began in 1950. During the spring and summer grazing periods, no browsing of pines was observed.

A recent report on longleaf pinelands in central Louisiana recommends that, if cattle are permitted to graze in young longleaf pine stands, the size and distribution of the herd should be controlled to prevent heavy grazing (5). The seedling stand should be examined frequently, during winter and early spring especially, to see if there is serious damage, and if corrective action is needed.

Cattle browsed the foliage of several hardwood species in early spring on the McNeill Forest, but all of the species grazed, except yellow-poplar, were considered to be of low quality for pinelands. It was found necessary to protect natural or planted yellow-poplar seedlings completely, by fencing out cattle until the trees were past the sapling stage.

Cattle Gains

The small native steers averaged 350 pounds when turned into the pastures. For the early part of the season, they gained about 1 pound per head per day, but thereafter gains were smaller as the nutrient content of the grasses declined. In the 3-year grazing period, steers gained an average of 82 pounds each in the short-season pastures and 115 pounds in the long-season pastures (table 7). But because the cattle-days of grazing were greater in the short-season pastures, the total gains averaged 353 pounds per year more than in the long-season pastures. In the 3-year period, annual weight gains averaged 7.2 pounds per acre in the short-season pastures and 5.3 pounds in the long-season pastures. Total gains averaged 1,198 pounds per year in the short-season pastures and 845 pounds in the long-season pastures.

Table 7.--Average gains, per steer, 1950-1952 1/

Year	Short-season pastures			Long-season pastures			Average all pastures
	A	F	Average	C	E	Average	
	- - - - - - - -			Pounds	- - - - - - - -		
1950	87	100	92	134	118	126	104
1951	73	75	74	101	152	127	92
1952	87	74	81	103	89	96	86
Average	82	81	82	111	120	115	93

1/ In 1950, pasture A was stocked with 14 head, pasture F with 10 head, and pastures C and E with 6 head each. In 1951 and 1952, pasture A had 18 head, F 14 head, and pastures C and E 8 head each.

In 1925-33, 3-year-old steers grazed an average of 217 days from April through November, with average stocking at 9 acres per head. The animals were larger, the forest stands were younger and more open, and steer gains somewhat higher than in the present study (fig. 8). The 1925-33 seasonal steer gains averaged 119 pounds per head on burned range as compared with 92 pounds per head on unburned range. In both studies, maximum cattle gains were made in the spring, when the forage was growing most rapidly. The rate of gain declined in summer as the forage matured and hot weather and flies hampered grazing.

In the earlier study, the cattle usually lost weight in August in both burned and unburned pastures, probably because fresh forage was scarce during this time on the closely grazed ranges. Thereafter they made fair gains in September and October, but all lost weight in November. Probably it was the lighter grazing in the 1950-52 study that permitted the steers to gain throughout the summer.

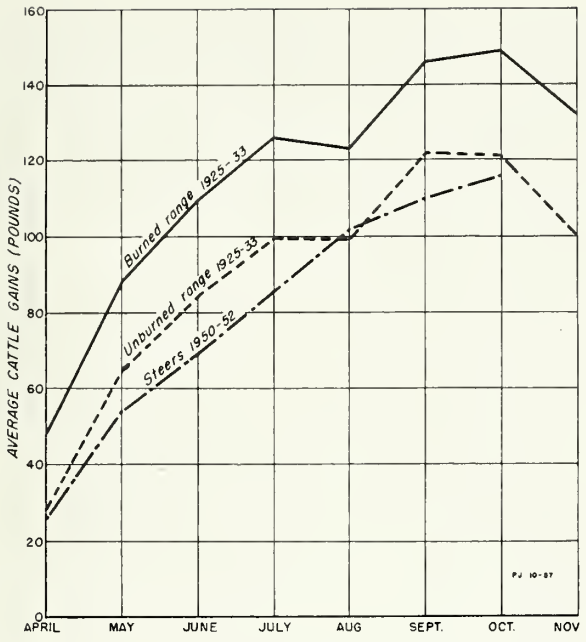

Figure 8.--Cumulative steer gains, 1925-1933 and 1950-1952.

In 1953 and 1954, a local farmer furnished animals to stock two of the study pastures. On April 7, 1953, 7 native cows with 7 calves were placed in Pasture A, and 5 cows, 4 calves, and 3 two-year-old heifers in Pasture C. At the end of 5 months, the cows in Pasture A averaged gains of 31 pounds, and the calves had gained 158 pounds per head. In Pasture C, cows gained 29 pounds, calves 136 pounds, and heifers 68 pounds.

In 1954, 12 cows and a bull were grazed in Pasture A. Pasture E was stocked with 12 yearling heifers. Grazing began April 5 and the cattle were removed July 21, at the end of 107 days of grazing. Two cows and one heifer bogged down and died. At the start, cows averaged 532 pounds and the heifers 350 pounds. Average gains were 121 pounds per head for cows and 56 pounds for heifers. Cow gains include the weights of 4 calves that were born on the range.

Cattle gains by pastures, years, and class of stock are shown in table 8. The class of stock seemed to have little influence on the total

Table 8.--Total cattle gains in short-season and long-season pastures

Year	Class of stock	Short-season pastures		Long-season pastures	
		A	F	C	E
		- - - - - - - Pounds- - - - - - -			
1950	Steers	1,220	996	804	710
1951	Steers	1,318	1,053	811	1,215
1952	Steers	1,564	1,035	820	710
1953	Mixed	1,320	(1/)	895	(1/)
1954	Mixed	1,330	(1/)	(1/)	2/620
Average		1,350	1,028	832	814

1/ Not stocked.
2/ Cattle in Pasture E during 1954 were heifers.

pounds of gain in any one pasture. Neither did the timber overstory appear to have a marked effect on total pasture gains, as Pastures A and C were moderately stocked with pine and Pastures E and F were relatively well stocked. The major difference in total gains per pasture appears due to the seasonal grazing treatments, as the short-season pastures (A and F) had approximately twice as many animals during the good spring season as did the long-season pastures (C and E).

Financial Aspects

The small steers used in this study were purchased in the spring, when prices for this grade of stock are normally high. They were sold in late summer or fall, when the market is usually at a seasonal low. Cattle prices fluctuated markedly in the three years of the study. They advanced in 1950, but fell off moderately in 1951. In 1952 there was a pronounced drop during the grazing season.

In the first year gross returns were large enough to cover all costs, including handling stock and other expenses, and still leave a substantial profit. In 1951 returns were somewhat less than direct costs, and in 1952 the sharp price decline caused a substantial loss (table 9).

Table 9.--Costs and returns from steers, 1950-1952 1/

Item	1950		1951		1952	
	Short season	Long season	Short season	Long season	Short season	Long season
	- - - - - -		-Dollars- - - - - -			
Purchase price per cwt.	20.79	20.73	29.31	29.31	26.44	26.64
Selling price per cwt.	25.50	21.24	22.38	23.12	14.04	13.57
Purchase cost per steer	74.00	74.00	94.39	94.39	94.66	100.17
Selling price per steer	114.24	102.59	88.62	103.69	59.81	58.89
Gain or loss	40.24	28.59	-5.77	9.30	-34.85	-41.28

1/ Other direct costs, including handling, commission sales, minerals, and medicines, varied from about $8.00 to $12.00 per animal yearly. The values above do not include shrinkage due to hauling to market.

Because stocker quality cattle normally decline in price between spring and fall, steers do not appear to be as promising a venture for forest grazing as a breeding herd. With a breeding herd, a cattle owner

using forest range can depend upon the sale of calves for annual income. Moreover he need not make cash expenditures for replacements in the herd. Of course, supplemental feed or pasture should be provided to keep the herd thrifty during the fall and winter, and other good management practices should be applied (1).

In a south Georgia study, with a high winter maintenance level of grazing on Bermudagrass pasture and hay, cows grazed on range in spring and summer and produced a 75-percent calf crop. Calves averaged 413 pounds at weaning (8). This is in contrast to the 57 percent calf crop and weaned-calf weight of 273 pounds from cows maintained at minimum levels in fall and winter.

In the early phases of a study in central Louisiana, a herd of common range cattle was given just enough cottonseed cake to keep the animals alive during winter. Beef production was low, with calf crops averaging about 50 percent and calves seldom weighing more than 300 pounds in the fall.

Beginning in 1954, one herd was fed adequate supplements on the range and other improved management practices were put into effect (6). Phosphorus was kept before the animals all year. Protein was fed as soon as the range forage dropped below minimum requirement for this nutrient, usually from November to May.

The animals responded rapidly; beef production more than doubled. In 1956 and 1957 calf crops averaged 85 percent, and calves weighed 453 pounds at 7 months of age[4]. The feed cost was $17.46 per cow or $20.63 per calf. The calves sold in August at an average price of $81.57, leaving $60.94 per calf for range and handling costs, interest on the investment, and profit to the owner.

RECOMMENDED RANGE AND HERD MANAGEMENT PRACTICES

Since steers were grazed in the spring and summer on the forest range and sold at the end of each grazing season, little information was obtained on yearlong herd management. However, the Louisiana studies indicate that the following measures are essential to the successful management of beef cattle on forest range:

[4] Data by Don A. Duncan and L.B. Whitaker, on file at Southern Forest Experiment Station.

Fence forest ranges to facilitate adequate supervision of the herds.
Provide salt, minerals, and water throughout the grazing season.
Treat animals periodically for parasites and diseases.
Use improved beef breeds and control the breeding season to make efficient use of forage.

Although burning to remove old grass and litter improves grazing, it is not essential for satisfactory utilization of the forest range in this territory. Where burning is done for forestry purposes, small burns are undesirable because cattle will concentrate on the burned area and overgraze it.

Adequate yearlong nutrition may be provided cattle herds on forest land either by feeding supplements on the range in fall and winter or by giving the animals other pasture or feed during this period. The McNeill results show that, if the first alternative is used, stock normally should be removed from the range about October 1 and placed on improved pastures until about March 15. Where cultivated fields are available, fall and winter pastures of oats, crimson clover, ryegrass, or other forage plants provide winter feed.

SUMMARY

Forest range is an important source of inexpensive forage for livestock on the Gulf Coastal Plain of south Mississippi and adjacent States. This study, on the McNeill Experimental Forest in Pearl River County, Mississippi, provides information about the amount and nutrient value of native forage under various stands and densities of second-growth longleaf pine. In 1947, when the study began, the pines were about 35 years old.

Four pastures, each of about 160 acres, were fenced. Two were rather well stocked with pine and two had only a moderate stand. Two of the pastures were grazed for 4 months (April 1 to July 31), and two for 7 months (April 1 to October 31). In 1950, 1951, and 1952, small, thin yearling steers were grazed; while in 1953 and 1954 supplemental tests were made with breeding cows. The short-season pastures were stocked with about twice as many animals as the long-season pastures, considering the forage available.

Bluestem grasses made up the bulk of the forage on the experimental areas, along with panicums, dropseed, threeawn, paspalums, carpetgrass, and certain palatable weeds and shrubs. In an earlier ex-

periment under rather heavy grazing, average grass density decreased from 70 percent in 1923 to 21 percent in 1933, and the valuable little bluestem lost ground to other grasses. By 1949, under light grazing and only periodic burning, the grass density increased to 28 percent and little bluestem regained its dominance.

As the pines grew and occupied more space, grass yields were reduced by competition from trees and by smothering from accumulated litter. Open pine stands produced an average of 850 pounds of green grass (air-dry) per acre annually during the three years 1947-1949, moderate stands produced 450 pounds, and dense stands grew 400 pounds.

Rainfall influenced grass production both seasonally and from year to year. Rainfall for the April-August period was roughly correlated with maximum grass growth during 1947-1953. About 70 percent of each year's grass production was reached by June and 85 percent by July.

Bluestem grasses contributed 81 percent of the average seasonal diet of steers, other grasses 13 percent, weeds 3 percent, and browse 3 percent (although browse was as high as 17 percent in March).

The experimental areas were lightly to moderately grazed during the study. Utilization averaged from 10 to 25 percent, but was somewhat greater in the immediate vicinity of logging roads, salt boxes, tree stumps, girdled trees, and water holes. On fresh burns, from 50 to 95 percent of the growth was utilized.

Chemical analyses of plant samples representing cattle diets varied from an adequate 9.02 percent crude protein in March to a below-maintenance low of 6.58 percent in September. New growth in spring and on previously grazed areas during summer had higher protein than older, more mature herbage. Calcium content apparently was adequate for animals needs, but phosphorus was not.

Grazing capacity for the experimental range was estimated at about 11 acres per cow for a 4-month season or 19 acres per cow for a 7-month season.

The experimental steers averaged 350 pounds in weight when placed on the pastures in March. Steers in the 4-month pastures gained an average of 82 pounds apiece, while those in the 7-month pastures gained 115 pounds.

Grazing damage to pine reproduction was negligible under the light to moderate grazing in this study, except on a few very localized areas where cattle concentrated and browsed or trampled some seedlings. How-

ever, it was necessary to fence out planted areas of yellow-poplar to prevent serious browsing of this species.

It is recommended that forest range grazing in this timber type be limited to spring and summer months, and that cattle be carried on low-cost pasture or other feed in winter.

COMMON RANGE FORAGE PLANTS ON THE MCNEILL PASTURES

Grasses

Andropogon scoparius	Little bluestem
A. elliottii	Elliott bluestem
A. virginicus	Yellowsedge bluestem
A. tener	Slender bluestem
A. ternarius	Paintbrush bluestem
Aristida purpurascens	Arrowfeather threeawn
Arundinaria tecta	Switch cane
Axonopus affinis	Carpetgrass
Gymnopogon ambiguus	Bearded skeletongrass
Panicum spp.	Panic grasses
Panicum virgatum	Switch grass
Paspalum floridanum	Florida paspalum
Sorghastrum nutans	Indian grass
Sporobolus gracilis	Pineywoods dropseed

Weeds

Helianthus radula	Swamp sunflower
Desmodium ciliare	Littleleaf tick clover
Lespedeza striata	Common lespedeza
Chrysopsis aspera	Grassleaf goldaster

Shrubs

Callicarpa americana	French mulberry
Myrica cerifera	Southern waxmyrtle
Cornus florida	Dogwood
Rubus allegheniensis	Blackberry
Symplocos tinctoria	Sweetleaf
Vaccinium spp.	Blueberry

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